

REMARKS

Status of the Claims

Following this Amendment, claims 1-20 are now pending in the application. Applicants have not introduced any new matter to the application.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Eyal et al. (U.S. Patent No. 5,766,439) and Ponnampalam et al. (U.S. Patent No. 6,284,904) in view of Zapp et al. Because the combination of the three cited references does not disclose or suggest each element of claims 1-20, Applicants respectfully traverse these rejections.

A *prima facie* case of obviousness has three distinct requirements. First, the references must teach or suggest every claim element. M.P.E.P. §§ 2142 and 2143.03. Second, there must be a motivation to modify or combine the teachings of the cited references, which may arise from the explicit content of the references, from common knowledge in the art, or from common sense. M.P.E.P. §§ 2143 and 2143.01; *KSR Int'l Co. v. Teleflex, Inc.* 127 S. Ct. 1727, 1742-43 (2007). Third, there must be a reasonable expectation of success in performing the modified or combined teachings of the references. M.P.E.P. § 2143.02.

According to the Office, Eyal et al. teaches the production of organic acids, including the steps of producing organic acids such as lactic acid by fermentation, neutralization with a carbonate salt, and reaction with ammonium carbonate, while Ponnampalam et al. teaches the purification of organic acids using anion exchange resins, including the release of the free acid from the resin by nitric acid. Office

Action, page 4. Zapp et al. is cited for the teaching that ammonium nitrate is utilized as a fertilizer. *Id.*

The Office Action reasons that while Eyal et al. does not teach the claimed step of acidifying the salt of an organic acid using nitric acid, and Ponnampalam et al. does not teach the conversion of a cation/nitrate salt to ammonium nitrate, it would have been obvious to use nitric acid in the process of Eyal et al. because “the process leads to the same products.” Office Action, page 5.

No combination of the three cited references, however, leads to the present invention. The instant claims recite a process that comprises three steps:

- A. reacting a cation/organic acid salt in a solution with nitric acid to acidify the organic acid and form a salt of the cation and nitrate, wherein the cation can form an insoluble carbonate salt;
- B. recovering the organic acid from the solution; and
- C. reacting the cation/nitrate salt with ammonium carbonate to form ammonium nitrate and an insoluble carbonate salt.

Eyal et al. discloses, at best, a process for producing organic acids by adding an alkaline earth base to a fermentation broth containing an organic acid, reacting the resulting alkaline earth salt of the organic acid with ammonium ions to produce the ammonium salt of the organic acid, and recovering the free organic acid by salt-splitting electrodialysis. Despite the Office's contention, Eyal et al. teaches a fundamentally distinct process that differs from the claimed invention in many more ways than simply failing to teach a step of reacting an organic acid salt with nitric acid.

Specifically, Eyal et al. teaches the reaction of an organic acid salt (*e.g.*, calcium lactate) with ammonium carbonate to form the ammonium salt of the organic acid. The present claims recite the reaction of a cation/nitrate salt (*e.g.*, $\text{Ca}(\text{NO}_3)_2$) with ammonium carbonate to form ammonium nitrate and an insoluble carbonate salt. The claims do not recite the reaction of an organic acid salt with ammonium carbonate, as disclosed in Eyal et al. In fact, the free organic acid has been recovered from the solution (step b) before ammonium carbonate is even added to the reaction. Eyal et al. does not teach the formation of a cation/nitrate salt, let alone its reaction with ammonium carbonate to form ammonium nitrate and an insoluble carbonate salt.

Eyal et al. also does not teach the step of recovering an organic acid from a solution after reacting a cation/organic acid salt in the solution with nitric acid, as recited in the instant claims. To the contrary, Eyal et al. discloses forming the ammonium salt of an organic acid and then recovering the free organic acid by salt-splitting electrodialysis. The present claims, in contrast, recite recovering the free organic acid and then reacting the remaining cation/nitrate salt (rather than the organic acid) with ammonium carbonate.

Finally, Applicants submit that, in addition to not teaching or suggesting a step of acidifying the salt of an organic acid using nitric acid (as recognized by the Examiner), Eyal et al. in fact teaches away from the use of an acid. Rather, Eyal et al. discloses that a basic pH of 7.0 or higher is desired when reacting the organic acid salt with ammonium carbonate. In particular, Eyal et al. teaches that

A preferred process for the formation of the ammonium lactate (or other organic acid salt) is to first react the precipitated calcium lactate with ammonia in an aqueous medium to raise the pH of the reaction media to about 7.0 or higher, and then add ammonium carbonate or other source of ammonium ion to raise the pH to the desired level to form soluble ammonium lactate.

Eyal et al., col. 5, lines 8-14. Thus, not only does Eyal et al. teach a fundamentally distinct process than that recited in the pending claims, the reference also teaches away from acidic reaction conditions. Applicants therefore submit that the Office has failed to recognize the many distinctions between Eyal et al. and the process recited in claims 1-20, as is required for by the *Graham* obviousness analysis.

The multiple shortcomings of Eyal et al. described above cannot be found in the disclosure of Ponnampalam et al. Ponnampalam et al. discloses a method to purify organic acids using anion exchange chromatography. In particular, the disclosed method involves binding an organic acid within a solution to a basic anion exchange resin, washing the resin, and then releasing the organic acid by elution with a stronger anion such as a strong inorganic acid (*e.g.*, nitric acid).

Ponnampalam et al. does not teach or even suggest (1) reacting a cation/organic acid salt in a solution with nitric acid to acidify the organic acid and form a salt of the cation and nitrate, wherein the cation can form an insoluble carbonate salt or (2) reacting the cation/nitrate salt with ammonium carbonate to form ammonium nitrate and an insoluble carbonate salt. Quite simply, Ponnampalam et al. discloses only the use of a strong acid such as nitric acid to elute bound carboxylic acids from a basic anion exchange resin.

Both the instant application and Eyal et al. do mention the use of ion exchange chromatography, but this disclosure is immaterial due to the distinct chemical reactions taught by each. Eyal et al. teaches that ion exchange chromatography may be used to remove divalent cations from the ammonium lactate solution prior to salt-splitting electrodialysis. Eyal et al., col. 5, lines 25-35. The present specification teaches that reactive separation means such as ion exchange chromatography may be used to recover organic acids. However, the Office's assertion that the claimed "process uses an ion exchange resin" ignores the fundamentally different reactions taught by Eyal et al. and recited in the instant claims, as discussed in greater detail above.

In view of the disclosures of Eyal et al. and Ponnampalam et al., Applicants disagree with the Office's assertion that "it would have been obvious to have used nitric acid in the process of Eyal et al as the process leads to the same products." Office Action, page 5. Indeed, Applicants can see no reason why one skilled in the art would combine the nitric acid used to elute an organic acid from an anion exchange resin as taught by Ponnampalam et al. with the reaction of an organic acid with ammonium carbonate as taught by Eyal et al. Even if such teachings were combined, the resulting process would not come close to the process recited in the instant claims.

The disclosure of Zapp et al. similarly fails to provide the claim elements missing from both Eyal et al. and Ponnampalam et al. Zapp et al. discloses a process for making ammonium nitrate from calcium nitrate and using the end product as a fertilizer. Zapp et al. is utterly devoid of any teaching or suggestion of

(1) reacting a cation/organic acid salt in a solution with nitric acid to acidify the organic acid and form a salt of the cation and nitrate, wherein the cation can form an insoluble carbonate salt or (2) recovering the organic acid from the solution.

None of the cited references, alone or in combination, teach or suggest acidifying a cation/organic acid salt with nitric acid to form an acidified organic acid and a salt of the cation and nitrate or the subsequent recovery of the resulting organic acid from the solution, as recited in each of the instant claims. Thus, neither Eyal et al., Ponnampalam et al., nor Zapp et al., either alone or in combination, teach or suggest each element of the pending claims. Accordingly, a *prima facie* case of obviousness has not been established, and Applicants respectfully request the withdrawal of these rejections.

Conclusions

In view of the foregoing amendments and remarks, Applicants respectfully request reconsideration and reexamination of this application and the timely allowance of the pending claims. If the Examiner has any questions regarding this Amendment and Response, the Examiner is invited to contact the undersigned at 303-863-9700.

In the event that additional fees are due in connection with this response,
please debit Deposit Account No. 19-1970.

Respectfully submitted,

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